Mapping Light. Data Impressionism.

Andrew Richardson

School of Design, Northumbria University
Newcastle, United Kingdom
andrew.richardson@northumbria.ac.uk

Abstract

Using a practical investigation as a sample case study, this paper outlines an initial investigation into the visualization of people's experiences within a city space. Highlighting the shortcomings of conventional data visualization approaches, it presents an argument for the use of light as a useful metaphor for mapping and connecting emotion with place. Inspired by the impressionistic painters, and their use of light as a means to capture the sense or mood of a scene, the project advocates light as a possible way to develop a kind of 'data impressionistic' approach for visualizing the data-informed mood of a location. The paper outlines the ongoing practical project work and prototypes, and looks forward to future opportunities and project developments during the next phases of work.

Keywords

Data, Visualization, Light, Location, City, Graphics, Impressionism.

Introduction

Data visualization is a broad discipline which utilizes clear, often diagrammatic, abstractions of graphical form to visually simplify otherwise complex information. Increased use and availability of digital data has given rise to a plethora of data visualization graphics which draw from a well-established gallery of diagrammatic visualization styles [1]. There is, however, a growing acknowledgement of the limitations of this kind of diagrammatic approach to visualization, especially when applied to experiential data sets, particularly those from humanities based subject areas. The aesthetic language of 'scientific' graphical data visualizations, it is argued, has a tendency towards visual reductionism; simplifying the 'messy' experiences of the phenomenal world into unchallenged images of objective truth. Data is presented as an expression of pre-existing truths - showing things as they 'already are' [2]. The authority afforded to these kinds of 'scientific' aesthetics imbues the images with an 'explanatory power' of the graphically sublime – perpetuating a 'fantasy of knowing' in which graphical beauty and style has equivalence to truth [3].

Alternative artistically inspired approaches challenge the 'scientific' aesthetic of visual truth telling, developing exploratory approaches to construct nuanced visual representations of reality, by molding and manipulating the 'formless, raw material' of data into visualizations which viewers can 'feel' as well as see [4, 5, 6]. These artistic, creative approaches represent explorations toward the pursuit of new forms of 'data humanism,' visual representations which attempt to express the essence of the phenomenal world embodied in experiential data, without resorting to reductive over simplifications [7]. This tension between 'scientific' and 'humanistic' visual approaches provides the background to the development of an ongoing creative investigation outlined in this paper. The project is a citizen-informed city mapping activity investigating creative ways to collect, gather, visualize and share personal experiences, thoughts, moods and emotions associated with city places, spaces and locations.

Mapping with Pens and Paper

The first phase of the activity explored simple physical methods to capture and visualize moods and emotions associated with locations around the city. Participants were invited to shade in areas of a map of their city using colored markers as a way of indicating emotions they associated with specific spaces and places. In this way, a series of maps were created with colored areas indicating 'quiet spaces' (green) 'happy spaces' (yellow), lively spaces (red) and 'social spaces' (blue) (see Fig 1).

Figure 1. A sample of the hand-colored maps created by participants in the initial mapping activity. Color is used to denote different moods associated with a location.

Using a computer vision programme, the shapes and colors data of each map were captured, stored as a list of JSON values, and then translated as uniform digital grid of circles.

This created a 'low-resolution' version of the hand-drawn maps, an abstracted colour-coded map of the city, in which areas and locations were visualized as stylized colored circles. The final results were displayed as an interactive web-based visualization; a 'mood map' of the city (see Fig. 2).

Although this approach had some engaging and informative elements, it had clearly identifiable shortcomings - most notably in the disconnections created between the users own mapping activity and the translation of these maps to create the final images and visuals. A lack of immediacy between the drawing and capture activities (each map had to be individually scanned after the drawing process) meant that an 'experiential disconnect' was created; users easily lost the connection between their own map and the on-screen visuals, failing to see the relationship between the two.

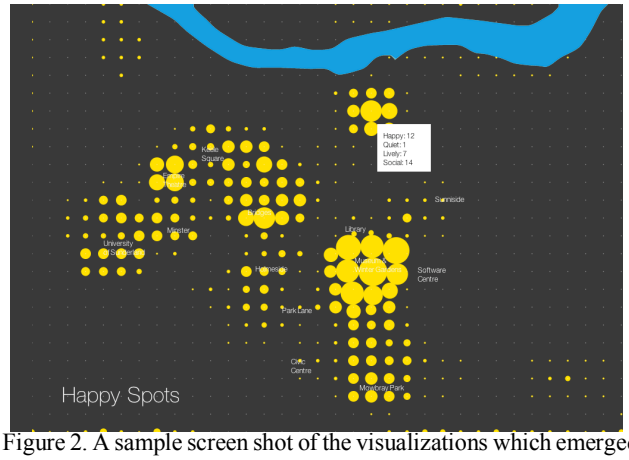

Figure 2. A sample screen shot of the visualizations which emerged from the paper mapping activity. The map is cleaned up into a uniform grid. This example illustrates the happy (yellow) areas.

The final visuals which tidied up the 'messiness' of the 'rough' pen and paper maps into a reassuringly precise grid of visual cleanness. also created a visual disconnection between the locatable, personalized maps of mood, location and memory and the highly stylized, numerically sorted graphical clean grid of circles. Despite the fact that the aesthetic authority graphics were visually suggestive of 'fact' and 'truth', they did not reflect the subtle ambiguous connections people expressed with city spaces, in which ideas of memory, mood and location are subjective and transient. This phase of the project highlighted the shortcomings of placing emphasis on a diagrammatic 'hard edged' data visualization aesthetic which lack the visual ability to communicate and display the subtleties of memory and emotional associated with this kind of transient data.

Mapping with Light and Sound

During the second project phase, an alternate mapping activity was prototyped to try to develop greater more direct visual connections between places and emotions, and to explore other, more nuanced, ways of capturing and connecting memory and place. Inspired by aerial maps of cities at night, in which lights indicate areas of high population density, the second iteration replaced the 'hard-edged' pen and paper activity and instead explored the use of light and sound as a way to capture, visualize and locate the transient qualities of emotion and memory connected with space and place.

The light and sound prototype encourages participants to document their significant places in the city via a tangible interface which allows them to add an audio recording of a memory as an individual 'bright spot' onto an interactive map, (see Fig. 3). Participants create digital lights to locate and record their own personal 'bright spots' directly onto the city map by placing a smart tangible 'locator' object onto an interactive map surface and speaking into it.

A Unity game engine is used to track the position of the object on the capacitive surface and locate its center and orientation. Placing and moving the locator over the surface allows users to explore places and other memories on the map and find where they wish to add their own 'bright spot'. Sound activation via a microphone input triggers an event to add a new spot and audio recording of their memory to the map.

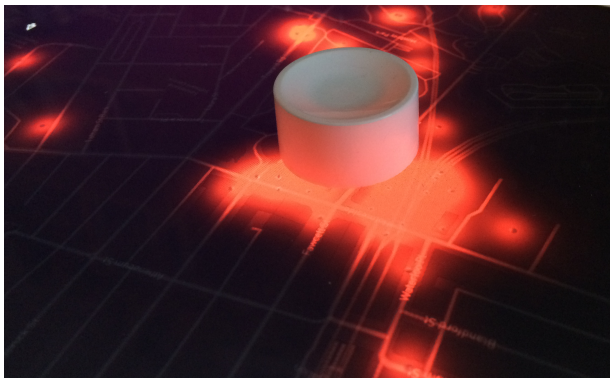

Figure 3. A detail from the prototype interactive map. The audio-activated locator object is moved over the touch-screen surface and allows the user to add their own 'bright spot' to the map.

Each individual memory is visually represented as a single light on the streets of the city map, with each colour representing a particular mood.

Outcomes and Visuals

The outcome is an interactive 'light and sound map' - a visualization of a city, illuminated by personal memories and thoughts mapped to significant places. Each area of light on the map represents a single, individual moment, encounter or memory. The data associated with each spot includes a short personal audio recording of the memory and its real-world GPS location, which allows each light to be re-visualized back into its physical location. Groups and collections of lights create hot spots; bright areas and regions of light - clusters which signify 'emotional activity' and intensity.

The overall visual image created from the process is an 'impressionistic' map of city spaces depicting 'emotional hotspots' across its streets (see Fig. 4). Unlike the previous iteration of the map, in which the locations of emotional

association are visually and closely defined and numbered, the emotional areas in these visualizations are softer, more 'painterly', giving an impressionistic suggestion of emotional locations and clustering.

The map has visual resonance with light clusters from aerial photographs of city lights, or NASA maps of the earth in which population activity and density is, similarly, indicated by light clusters [8]. However, rather than being indicative of the physical presence of people, this light map provides a representation of areas of emotional density. Streets are revealed, and lit up by user engagement; whilst less 'emotionally' significant place are left in darkness.

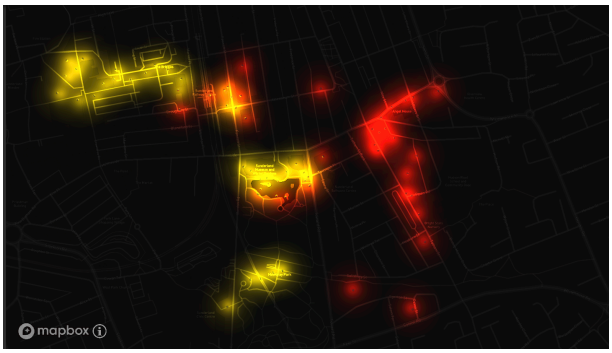

Figure 4. The outcome of the mapping activity is a visually softer version of the data. Colors denoting mood combine and merge to create a more 'painterly' visualization of moods in spaces.

Light as a Metaphor for Visualization

The examples from this mapping project begin to explore the ways in which light can provide a useful and important metaphor, especially for mapping and visualizing data connected with memory and emotion in the context of place and space.

The use of light as a means of connecting place and space works, both as a formal construct, having direct physical associations with geography, population and location and also as a metaphor which has strong emotional associations with human memory and imagination. The visual softness of light does not have the 'cut-and-dried' certainty of the numerically defined hard edges of diagrammatic design, but instead offers a connection with the uncertainties and haziness of memory and place. Particular features of the lighting within the digital space e.g. luminosity, range, intensity and color, are combined and applied to further enhance the visual nuance and help develop links between the transience of personal imagination to ideas of location and space.

Using light and sound as way to express something of the sense of a place also has conceptually interesting links to other artistic representations of place and landscape, with particular resonance with impressionistic approaches to representations of place. Just as the impressionist painters sought to capture a version of reality removed from the 'realism' of formal painting and photography, seeking instead to capture the 'reality' of the atmosphere of a place, so this kind of 'data impressionism' - using light and sound to capture and visualize the reality of the 'sense' of a place - can be seen as an attempt to go beyond the hard edge realism of traditional data graphics, in order to capture and communicate something of its essence. The impressionist's reaction to the realism aesthetic and their use of light as the 'creative principle' underlying the 'reality' of the mood of a scene provides an instructive and potentially fruitful model for the exploration of the qualities of light as a tool for data visualization of place and space [9].

Rather than the 'scientific realism' of data graphics which 'flatten' data into a single type of 'unknowable image' [10], the use of light begins to create an overall impressionistic sense of realism – a human centered data visualization and a more compelling complex starting point for seeing and understanding the subtleties of individual personal spaces. Unlike the 'Kantian sublime' aesthetics of big data visualizations, the aesthetics and data of this visualization do not inspire awe and wonder from a sense of unimaginable scale, but evoke the human-centeredness of localized places and spaces - creating audio-visual impressions of familiar streets and locations [11]. The soft edges of the light-informed data visualization create a 'sense' of the data in the place which may lack the 'hard-edged' 'truthfulness' of data graphics but perhaps creates a representation of the transience of real and imagined spaces. This may be seen as a type of 'data impressionistic' style – an approach which uses light to try to emphasize the *affectiveness,* of the visuals in trying to invoke a sense of the moods associated within the space [12].

Future Work and Development

The work outlined in this paper is part of a larger investigation already in progress, however the idea of using light as a means to visualize and connect place and memory has already offered a fruitful way forward for the future direction of this work. The project will continue this exploration of mapping with light, looking in particular at ways of sharing the data from the map back into the city spaces.

As well as being a useful way of visualizing activity within a screen space, the physicality of light also presents great opportunities to be mapped back into the spaces and locations identified on the map [13]. With this in mind, the next phase of the work will look at the development and use of smart location-based objects and lights to re-visualize the areas of light back within the physical spaces, allowing users and participants to re-discover and connect with the data as they move around the city – thus providing an interesting way of re-visualizing the 'hidden' data back into the specific locations. The work from this phase of the project will be available for dissemination during the main phase of the conference.

Conclusion

This paper has briefly outlined approaches towards mapping and visualizing emotional spaces within a city, and has begun to show how the concept of light can be an informative visual tool or symbol which connects ideas of place and emotion.

Having a connection with physical city spaces and with notions of imagination and memory, light provides a useful metaphor for connecting emotion and space. The association with some of the broad aims and ideals of the impressionistic movement provides a useful way of thinking about new kinds of approaches to data visualization which develop a 'sense' of the reality of the data which is able to embrace the softer side of data, to include nuance and subtlety. It is hoped that this approach can be informative and useful for future developments and explorations within the field of creative data visualization.

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Author Biography

Andrew Richardson is a senior lecturer within the Design School at Northumbria University. He lectures on the Interaction Design programme and his research concerns the use of creative coding for development of novel data visualisations.